CLAIMS

What is claimed is:

1. A method of programming an antifuse, said antifuse comprising a material that is substantially non-conductive when said antifuse is unprogrammed, said material being disposed between and in electrical contact with a first conductive element and a second conductive element, said method comprising:

passing a current limited pulse through said material so as to drive material from said first conductive element into said material as a conductive filament; and

passing a second pulse through said material in the opposite direction of said current limited pulse so as to drive material from said second conductive element into said material thereby increasing the cross sectional area of said conductive filament and reducing the resistance of said antifuse;

wherein the current in said current limited pulse is lower in magnitude than the current in said second pulse.

2. The method of Claim 1, wherein said current limited pulse and said second pulse have approximately the same voltage with opposite polarity.

3. The method of Claim 1, wherein said current in said current limited pulse is 20 to 33 percent lower in magnitude than said current in said second pulse.

4. The method of Claim 1, further comprising:

passing a third pulse through said material in the same direction as the current limited pulse, said third pulse being greater in magnitude than said current limited pulse, said third pulse further reducing the resistance of said antifuse.

5. The method of Claim 1,

wherein passing a current limited pulse through said material comprises applying a first voltage to said first conductive element and applying a second voltage to said second conductive element, said second voltage being greater in magnitude than said first voltage, and limiting the current to a desired magnitude; and

wherein passing a second pulse through said material comprises applying said second voltage to said first conductive element and applying said first voltage to said second conductive element.

6. The method of Claim 1, wherein said material comprises amorphous silicon and said conductive filament comprises silicide.

7. The method of Claim 1, further comprising passing a plurality of a current limited pulses through said material prior to passing said a second pulse through said material.

8. The method of Claim 7, wherein passing a plurality of a current limited pulses through said material comprises passing at least two current limited pulses through said material, said at least two current limited pulses being opposite in polarity.

9. A method of programming an antifuse, said antifuse comprising a material that is substantially non-conductive when said antifuse is unprogrammed, said material being disposed between and in electrical contact with a first conductive element and a second conductive element, said method comprising:

applying a prepulse to said material, said prepulse having a current of a first magnitude that drives material from said first conductive element into said material as a conductive filament; and

applying a programming pulse to said material, said programming pulse having a current of a second magnitude that drives material from said second conductive element into said material adding to said conductive filament;

wherein said current of a first magnitude is lower than said current of a second magnitude.

10. The method of Claim 9, wherein said current of a second magnitude is 20 to 33 percent greater in magnitude than said current of a first magnitude.

11. The method of Claim 9,

wherein said prepulse has a first voltage applied to said first conductive element and a second voltage applied to said second conductive element; and

wherein said first programming pulse has said second voltage applied to said first conductive element and said first voltage applied to said second conductive element.

12. The method of Claim 9, wherein said current of said programming pulse is applied in the opposite direction of said current of said prepulse.

13. The method of Claim 12, further comprising applying a second programming pulse to said material, said second programming pulse having a current of a third magnitude, said current of said second programming pulse being applied in the same direction said current of said prepulse.

14. The method of Claim 13, wherein said third magnitude is not greater than said second magnitude.

15. The method of Claim 13, wherein said third magnitude is greater than said second magnitude.

16. The method of Claim 13, further comprising repeatedly applying said first programming pulse and said second programming pulse a predetermined number of times.

17. The method of Claim 13, further comprising repeatedly applying said first programming pulse and said second programming pulse until the resistance of said antifuse is below a predetermined value.

18. The method of Claim 9, further comprising applying a plurality of prepulses to said material prior to applying said programming pulse.

19. The method of Claim 18, comprising:

applying a first prepulse to said material, said first prepulse having a current of a third magnitude that is less than said second magnitude; and

applying a second prepulse to said material after said applying a first prepulse to said material, wherein said second prepulse has said current of a first magnitude;

wherein said first prepulse has approximately the same voltage with opposite polarity as said second prepulse.

20. The method of Claim 19, wherein said third magnitude is approximately equal to or greater than said first magnitude.

21. A method of programming an antifuse, said antifuse comprising a material that is substantially non-conductive when said antifuse is unprogrammed, said method comprising:

applying a first voltage across said material and a first current through said material, said first current driving a conductive filament with a first cross sectional area through said material; and

applying a second voltage across said material and a second current through said material, said second voltage having the same magnitude and opposite polarity as said first voltage, said second current having a greater magnitude and opposite polarity as said first current, said second current increasing the size of said conductive filament to a second cross sectional area, said second cross sectional area being greater than said first cross sectional area;

wherein said first current having insufficient magnitude to produce a conductive filament with said second cross sectional area.

22. A method of programming an antifuse, said antifuse comprising a material that is substantially non-conductive when said antifuse is unprogrammed, said method comprising:

applying at least one prepulse to said material, said prepulse including a first current to drive a conductive filament through said material, said first current having insufficient magnitude to produce said conductive filament with a desired resistance; and

applying at least one programming pulse to said material after the application of said at least one prepulse, said programming pulse including a second current having a greater magnitude than said first current to increase the cross sectional area of said conductive filament and to decrease the resistance of said conductive filament to a desired resistance..

23. The method of Claim 22, wherein said prepulse and said programming pulse have the same magnitude voltages with opposite polarities.

Sub A6

24. The method of Claim 22, comprising applying a plurality of prepulses to said material.

Sub B8

25. The method of Claim 24, wherein said plurality of prepulses have approximately the same currents with opposite polarities.